

ORIGINAL ARTICLE

Personality traits and risk of posttraumatic stress disorder among dental residents during COVID-19 crisis

Margot Metz BA¹ | Rachel Whitehill BA, AS¹ |
Hosam M. Alraiqq BDS, MSD, MA, EdD, CHES^{1,2}

¹College of Dental Medicine, Columbia University, New York, New York, USA

²National Institute of Dental and Craniofacial Research, Bethesda, Maryland, USA

Correspondence

Margot Metz, BA, 622 W 168th Street, New York, NY 10032, USA.

Email: mm5486@cumc.columbia.edu

Abstract

Purpose/objectives: The coronavirus disease 2019 (COVID-19) pandemic has presented mental health challenges among healthcare professionals, including posttraumatic stress disorder (PTSD). Few studies have examined PTSD predictors in dental settings. This cross-sectional study aimed to describe the relationship between personality traits and PTSD symptoms among US dental residents engaged in patient care during the pandemic.

Methods: An online survey was administered to residents in advanced education in general dentistry, dental anesthesia, general practice residency, oral and maxillofacial surgery, and pediatric dentistry programs between September 2020 and April 2021. The survey included a sociodemographic questionnaire, the Big Five Inventory, and the PTSD Checklist for *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition*. Logistic regression models, analysis of variance, and Tukey tests were used to examine the association between variables and PTSD scores and assess differences in personality traits and PTSD by specialty.

Results: Among 149 respondents (mean age = 29.9 ± 4.9 years; 57.0% female), 53.7% reported experiencing stress during the pandemic. Many residents (38.9%) were not aware of available mental health resources. A total of 17.4% of residents met the diagnostic criteria for PTSD, but only 1.3% reported a previous PTSD diagnosis. The most significant predictors of PTSD were neuroticism (odds ratio = 2.90, $p = 0.046$) and stress unrelated to the resident's program role during the pandemic (odds ratio = 5.88, $p = 0.02$).

Conclusions: PTSD symptoms were highly prevalent among dental residents, with stress and neuroticism being the most significant predictors.

KEYWORDS

COVID-19 pandemic, dental residency, neuroticism, occupational stress, PTSD

1 | INTRODUCTION

The coronavirus disease 2019 (COVID-19) crisis has posed unprecedented challenges to medical and dental professions worldwide. Healthcare professionals treat-

ing patients during pandemics have a higher risk of burnout, fatigue, and mental health problems,¹ including posttraumatic stress disorder (PTSD).² PTSD can be induced by exposure to a traumatic event and is characterized by hyperarousal, decreased responsiveness to

trauma-associated stimuli, and functional impairment.^{3,4} These psychological consequences can persist for years.^{1,4} Dental professionals are considered among the most vulnerable healthcare practitioners^{5–9} because they are routinely exposed to oral mucosa and potential viral transmission through aerosolization, salivary and nasopharyngeal droplets, and contamination of dental instruments.^{6,10} As a result, dentists have experienced particularly high levels of psychological distress during the COVID-19 pandemic.^{2,9,11,12} Dental education has not been spared, as lockdowns and safety protocols have necessitated rapid changes that include transitioning to online courses and reducing or halting clinical training.^{1,13} These changes, combined with isolation, fear of exposure to the virus, and uncertainty about the future, have resulted in a marked increase in mental health issues among dental residents.^{6,10,14–16}

Dentists and dental residents generally have high levels of stress and anxiety and a significantly greater risk of experiencing mental health issues, including PTSD.^{9,17,18} Previous studies have found that fatigue due to long working hours,¹⁹ frustration about the suspension of research activities and the inability to complete clinical training,^{8,13,14,20} and uncertainty about financial obligations and future employment prospects^{14,20,21} have contributed significantly to psychological distress and burnout. Several researchers have reported that anxiety, depression, and PTSD during training are associated with greater intention to leave a dental program¹⁵ and pursue a different career.²² The development of PTSD during residency is especially concerning during the traumatic events of the pandemic, as this disorder has long-term repercussions for professional effectiveness,¹⁷ such as heightened irritability, reduced concentration, alteration in sleep patterns, and increased absenteeism.⁴ In addition, PTSD has specific guidelines for its treatment that differ from the treatment of other mental disorders, such as anxiety and depression.²³

While external pandemic-related factors can play important roles in the development of PTSD, intrinsic factors such as personality traits are key to determining an individual's risk of PTSD, to understanding why some develop PTSD after a traumatic event whereas others do not and to describing and predicting symptom formation, severity, and outcomes.²⁴ Certain personality traits in the five-factor model (agreeableness, conscientiousness, extraversion, neuroticism, and openness), also known as the Big Five Inventory (BFI),²⁵ have been consistently associated with common mental disorders,^{24,26} and numerous studies have linked the development of PTSD to traits such as high neuroticism and low conscientiousness.^{24,26,27} In contrast, high extraversion and high conscientiousness have been associated with positive mental health and

adaptive coping skills and may be protective against PTSD.^{24,27,28}

Although there is evidence that certain medical professionals, such as surgeons, possess more PTSD-protective personality traits than others,^{29,30} few studies have examined the personality traits of dental professionals and the association of these traits with the development of mental health problems. Thus, it is important to examine the personality traits and risk of PTSD among future dental professionals, especially in the context of the COVID-19 crisis. This cross-sectional study therefore aimed to (1) describe personality traits and current PTSD symptoms among dental residents enrolled in various specialty programs across the US and (2) assess any associations between specific personality traits and the development of PTSD symptoms.

2 | MATERIALS AND METHODS

This study was approved by the institutional review board of Columbia University Irving Medical Center (protocol no. AAAT1588). All participants provided electronic informed consent before taking the survey.

2.1 | Setting and participants

A cross-sectional online survey was administered to a convenience sample of US dental residents from primary care and hospital-based specialty programs, including general practice residency (GPR), advanced education in general dentistry (AEGD), pediatric dentistry (PED), oral and maxillofacial surgery (OMFS), and dental anesthesia (DA).

2.2 | Data collection

Anonymous Qualtrics survey links were sent to the program directors and administrators of the selected programs between September 2020 and April 2021. Programs that agreed to participate received an email with a link to the survey as well as three additional weekly emails as reminders to their dental residents. All participants who completed the entire survey were anonymously entered into a drawing for a prize or asked to choose a charity program that would receive a small monetary donation on their behalf.

The survey consisted of three parts: a sociodemographic and background information questionnaire (14 items), the BFI personality scale (44 items), and the PTSD Checklist for the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5)* (20 items). The

sociodemographic survey included questions about the resident's dental specialty and city, school year, age, gender identification, race and ethnicity, place of birth, military status, role during the COVID-19 pandemic, previous PTSD history, sources of any stress, and availability of mental support services. Sociodemographic factors were collected because such variables may confound the relationship between personality traits and PTSD.^{18,31,32}

The Big Five personality traits can be measured using a variety of instruments, including the Neuroticism/Extraversion/Openness Personality Inventory,²⁵ Trait Descriptive Adjectives survey, and the BFI, which come in a variety of lengths.³³ Our survey used the 44-item BFI because of its brevity. It is also the most widely accepted model of personality,³⁴ with average alpha reliabilities above 0.80 and average 3-month test-retest reliability of 0.85.³⁵

The BFI measures five factors or dimensions of personality.³³ The inventory includes 44 statements related to the personality traits of openness (10 items), extraversion (eight items), agreeableness (nine items), conscientiousness (nine items), and neuroticism (eight items). Responses are scored on a five-point Likert scale, with 0 indicating "strongly disagree" and 4 indicating "strongly agree." Total personality scores for each of the five traits were reported as the means (more details about the Big Five dimensions are available in Table 1).³⁵

The 20-item PTSD Checklist for *DSM-5* (PCL-5)^{36,37} was used to screen and monitor the severity of PTSD symptoms experienced in the past month using a five-point Likert scale, with 0 indicating "not at all" and 4 indicating "extremely." The PCL-5 screens for PTSD symptoms in four areas: intrusive symptoms, avoidance, negative changes in thoughts and mood, and changes in arousal and reactivity.³⁸ The total symptom severity score ranges from 0 to 80, with 31–33 as the suggested optimal threshold score for a provisional diagnosis of PTSD.³⁹ For the bivariate analyses, the PTSD score was dichotomized, with a cutoff score of 31 used to distinguish between diagnostic and non-diagnostic scores. The PCL-5 has been reported to have excellent internal consistency, ranging from 0.90 to 0.96,^{40,41} as well as good convergent ($r_s = 0.74$ – 0.85) and discriminant ($r_s = 0.31$ – 0.60) validity.³⁶

Categorical independent variables were also grouped. For example, race and ethnicity were categorized as White or non-White, and class year was divided into first year, second year and higher, or recently graduated. In addition, residency programs were grouped into primary care for adults (AEGD and GPR), primary care for children (PED), and other hospital-based specialty programs (OMFS and DA).

After completing the survey, respondents were provided access to their scores and a brief explanation of what the

TABLE 1 Big Five personality dimensions, facets, and traits from John and Srivastava³⁵

Big Five dimension	Facet (correlated trait)
Agreeableness versus antagonism	Altruism (warm)
	Compliance (not stubborn)
	Modesty (does not show off)
	Straightforwardness (not demanding)
	Tender-mindedness (sympathetic)
	Trust (forgiving)
Conscientiousness versus lack of direction	Achievement striving (thorough)
	Competence (efficient)
	Deliberation (not impulsive)
	Dutifulness (not careless)
	Order (organized)
	Self-discipline (not lazy)
Extraversion versus introversion	Activity (energetic)
	Assertiveness (forceful)
	Excitement-seeking (adventurous)
	Gregariousness (sociable)
	Positive emotions (enthusiastic)
	Warmth (outgoing)
Neuroticism versus emotional stability	Anger and hostility (irritable)
	Anxiety (tense)
	Depression (not contented)
	Impulsiveness (moody)
	Self-consciousness (shy)
	Vulnerability (not self-confident)
Openness versus closedness to experience	Actions (wide interests)
	Aesthetics (artistic)
	Fantasy (imaginative)
	Feelings (excitable)
	Ideas (curious)
	Values (unconventional)

scores meant, as well as a disclaimer explaining that the scores were not a substitute for medical advice. Links to online mental health resources were provided to all participants.

2.3 | Statistical analysis

The association between independent variables and PTSD scores was investigated using simple and binary logistic regression models. Variables were included in the multivariable model if their corresponding *p*-values in the simple regression analysis were less than 0.05 or if they were associated with PTSD, as described in the literature. For all outcomes in the simple and logistic regression

models, we reported odds ratios (ORs), 95% confidence intervals (CIs), and related p -values. Analysis of variance (ANOVA) and post hoc Tukey tests were used to assess differences in the means of the Big Five personality traits and PTSD scores by dental specialty. Data were analyzed using IBM SPSS Statistics, version 25 (IBM Corp., Armonk, NY, USA).

3 | RESULTS

A total of 205 responses from dental residents were logged in the Qualtrics survey. The final sample included 149 residents who provided complete answers to questions related to the outcome variables of PTSD and personality trait scores (a descriptive overview of the final sample is provided in Table 2). The mean age of respondents was 29.9 ± 4.9 years; most respondents were born in the US (73.8%) and primarily identified as female (57.0%) and White (55.0%). Almost one-half of residents (45.6%) were enrolled in a program in the northeast, while 23.5% were working in the south, 17.4% were in the midwest, and 12.8% were in the west. Specialty representation was highest for GPR (34.9%) and lowest for DA (5.4%), with relatively similar proportions for OMFS (20.1%), PED (20.8%), and AEGD (18.8%). The majority of residents (74.7%) reported seeing patients during the pandemic. Of those who saw patients, 43.6% treated regular dental patients, 21.5% cared for dental emergencies only, and 20.1% were deployed to treat non-dental patients with COVID-19-related issues. A small proportion of residents (14.3%) reported being assigned to administrative roles or asked to stay home. The residents' roles during the pandemic differed based on residency type; most GPR (80.8%), AEGD (82.1%), and OMFS (66.7%) residents saw dental patients during the pandemic, whereas most PED (41.9%) and DA (75.0%) residents saw COVID-19 patients, which included the administration of COVID-19 tests and physical treatment of COVID-19 symptoms (Table 3).

Most residents (53.7%) reported experiencing a stressful event during the pandemic, with 26.2% indicating they had a stressful experience related to their role as a resident and 27.5% indicating they experienced stress unrelated to their role as a resident. Overall, 26 residents (17.4%) had PCL-5 symptom scores that were higher than the diagnostic threshold for PTSD.

Residents most commonly cited open communication with program directors (46.3%) and wellness events (47.7%) when asked about available mental health resources. A large proportion of respondents (38.9%) reported that they were not aware of any mental health resources offered by their programs.

3.1 | PTSD and personality traits among dental residents

The mean score for PTSD symptoms was 15.25 ± 13.72 . Personality trait scores were highest for agreeableness (3.98 ± 0.48) and lowest for neuroticism (2.78 ± 0.70). The ANOVA showed a statistically significant difference in the mean scores for neuroticism, conscientiousness, and PTSD across the various specialties (Table 4). Post hoc Tukey tests revealed that the mean neuroticism scores of DA/OMFS residents were lower than those of AEGD/GPR residents ($p = 0.03$) and PED residents ($p = 0.03$). There was no statistically significant difference in mean neuroticism scores between AEGD/GPR residents versus PED residents ($p = 0.36$). Similarly, the mean PTSD scores of DA/OMFS residents were significantly lower than those of AEGD/GPR ($p = 0.05$) and PED ($p = 0.05$) residents. There was no statistically significant difference in mean PTSD scores between AEGD/GPR versus PED residents ($p > 0.99$). Mean scores for conscientiousness differed significantly across all programs, with DA/OMFS residents having significantly higher scores than AEGD/GPR ($p = 0.02$) and PED ($p < 0.001$) residents.

Neuroticism (OR = 3.76, 95% CI = 1.84–7.71, $p < 0.001$), conscientiousness (OR = 0.44, 95% CI = 0.22–0.91, $p = 0.03$), and both role-related (OR = 3.40, 95% CI = 1.10–14.00, $p = 0.04$) and non-role-related (OR = 9.10, 95% CI = 2.73–30.30, $p < 0.001$) stress were all significantly associated with diagnostic PTSD scores in the bivariate analysis (Table 5). Multiple logistic regression analysis indicated that, overall, stress that was non-role-related (adjusted OR [aOR] = 5.88, 95% CI = 1.40–24.69, $p = 0.02$) and neuroticism (aOR = 2.90, 95% CI = 1.02–8.26, $p = 0.046$) were the most significant predictors associated with diagnostic PTSD scores. Among the three variables that were significantly correlated with PTSD scores in the bivariate results, a negative correlation was found between neuroticism and conscientiousness ($r = -0.322$, $p < 0.001$), and a positive correlation was found between neuroticism and role-related stress ($r = 0.273$, $p < 0.001$).

4 | DISCUSSION

This cross-sectional study aimed to describe personality traits and current PTSD symptoms among US dental residents enrolled in primary care and hospital-based residency programs and assessed the association between personality traits and PTSD symptoms. Among 149 dental residents included in the analysis, 26 residents (17.4%) met the diagnostic criteria for PTSD. This percentage is

TABLE 2 Participant characteristics

Characteristic	Participants, no. (%) (N = 149)
Gender pronouns	
He/his	61 (40.9)
She/her	85 (57.0)
Other	3 (2.0)
Race and ethnicity ^a	
Asian or Asian American	39 (26.2)
Black or African American	4 (2.7)
Hispanic or Latinx	13 (8.7)
Middle Eastern or North African	20 (13.4)
White or European American	82 (55.0)
Other (not Native American, Alaskan Native, or Pacific Islander)	4 (2.7)
Place of birth	
US	110 (73.8)
Outside of US	40 (26.8)
Unknown	9 (6.0)
Age group (years)	
25–30	69 (46.3)
31–34	58 (38.9)
≥35	21 (14.1)
Unknown	1 (0.7)
Dental program	
AEGD	28 (18.8)
DA	8 (5.4)
GPR	52 (34.9)
OMFS	30 (20.1)
PED	31 (20.8)
Class year (N = 148)	
1 (incoming)	46 (30.9)
2	38 (25.5)
3	6 (4.0)
4	3 (2.0)
5	1 (0.7)
6	2 (1.3)
Graduated in 2020	52 (34.9)
Military status	
Military or military related	11 (7.4)
Civilian	138 (92.6)
Program location	
Midwest	26 (17.4)
Northeast	68 (45.6)
South	35 (23.5)
West	19 (12.8)
Unknown	1 (0.7)

(Continues)

TABLE 2 (Continued)

Characteristic	Participants, no. (%) (N = 149)
Residency role during COVID-19 pandemic	
Not required to treat patients	11 (7.4)
Continued to treat patients, providing all types of dental services	65 (43.6)
Continued to treat patients but only saw dental emergencies	32 (21.5)
Redeployed to care for COVID-19 patients with non-dental responsibilities	30 (20.1)
Required to do something else (e.g., administrative work or telehealth)	11 (7.4)
Average work time during COVID-19 pandemic (days/week)	
0 (not required to work)	16 (10.7)
1–2	6 (4.0)
3–4	23 (15.4)
5	77 (51.7)
>5	27 (18.1)
Mental health services/resources made available during COVID-19 pandemic ^a	
Cognitive process therapy	7 (4.7)
Grief and loss services	28 (18.8)
Medication management	10 (6.7)
Open communication with directors	69 (46.3)
Referral to PTSD clinic	5 (3.4)
Support groups and counseling	32 (21.5)
Wellness events	71 (47.7)
None that student was aware of	58 (38.9)
Stressful experience	
None	69 (46.3)
Stress related to resident role	39 (26.2)
Stress not related to resident role	41 (27.5)
PTSD score ^b	
Higher than diagnostic threshold	26 (17.4)
Lower than diagnostic threshold	123 (82.6)

Abbreviations: AEGD, advanced education in general dentistry; COVID-19, coronavirus disease 2019; DA, dental anesthesia; GPR, general practice residency; OMFS, oral and maxillofacial surgery; PED, pediatric dentistry; PTSD, posttraumatic stress disorder.

^a Respondents could select more than one category.

^b Measured by the PTSD Checklist for the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (score range, 0–80). The threshold score for a provisional diagnosis of PTSD was 31.

TABLE 3 Redeployment during the coronavirus disease 2019 (COVID-19) pandemic by residency type

Residency type	Total participants	No. (%)		
		Did not see dental patients	Saw dental patients	Saw COVID-19 patients
AEGD	28	3 (10.7)	23 (82.1)	2 (7.1)
DA	8	0	2 (25.0)	6 (75.0)
GPR	52	8 (15.4)	42 (80.8)	2 (3.8)
OMFS	30	3 (10.0)	20 (66.7)	7 (23.3)
PED	31	8 (25.8)	10 (32.3)	13 (41.9)

Abbreviations: AEGD, advanced education in general dentistry; DA, dental anesthesia; GPR, general practice residency; OMFS, oral and maxillofacial surgery; PED, pediatric dentistry.

TABLE 4 Personality trait and posttraumatic stress disorder (PTSD) scores by dental specialty groups

Personality trait	Score, mean (range)				p-Value
	All programs (n = 149)	PED (n = 31)	AEGD/GPR (n = 83)	DA/OMFS (n = 32)	
Agreeableness	3.98 (3.90–4.05)	3.97 (3.80–4.14)	4.00 (3.90–4.09)	3.93 (3.74–4.13)	0.43
Conscientiousness	3.83 (3.73–3.92)	3.76 (3.56–3.95)	3.70 (3.55–3.84)	4.16 (4.00–4.31)	<0.001
Extraversion	3.25 (3.13–3.37)	3.13 (2.89–3.36)	3.23 (3.07–3.34)	3.40 (3.14–3.66)	0.28
Neuroticism	2.78 (2.67–2.89)	2.77 (2.51–3.03)	2.90 (2.75–3.04)	2.54 (2.29–2.79)	0.04
Openness	3.50 (3.42–3.58)	3.43 (3.23–3.63)	3.50 (3.39–3.61)	3.56 (3.41–3.70)	0.56
PTSD	15.26 (13.03–17.49)	11.80 (7.95–15.80)	18.10 (14.90–21.20)	12.10 (7.10–17.00)	0.02

Abbreviations: AEGD, advanced education in general dentistry; DA, dental anesthesia; GPR, general practice residency; OMFS, oral and maxillofacial surgery; PED, pediatric dentistry.

about three times higher than the estimated 4.7% prevalence of PTSD in the general US population⁴² and nearly twice as high as the estimated 10% prevalence of PTSD among rescue personnel worldwide.⁴³ Despite the high PTSD prevalence among dental residents in our sample, only two residents (1.3%) reported a previous PTSD diagnosis, suggesting a lack of mental health screening among residents or an underreporting of PTSD diagnoses. Individuals are generally more likely to underreport mental health issues than other illnesses.⁴⁴

The association between previous PTSD diagnosis and PTSD scores was not significant ($p = 0.06$), possibly due to the small sample size ($n = 2$). In agreement with our findings indicating a lack of association between program experience and PTSD scores, a previous study¹⁸ among surgical residents found no association between specialty program year and PTSD levels.

Inconsistent with prior reports that showed that female participants were more likely than male participants to meet diagnostic criteria for PTSD³¹ and that military service significantly increased the risk of developing PTSD,³² we found that the sociodemographic characteristics of dental residents did not significantly contribute to PTSD scores. However, our analysis included a small sample of residents ($n = 11$) with military backgrounds.

Neuroticism and stress were the most significant predictors of diagnostic PTSD scores among all factors investigated in this study, implying that dental residents with a high level of neuroticism who are exposed to stressful situations are more prone to developing PTSD. The link between neuroticism and PTSD is well established in the literature.^{24,26,27,45} Although the profile of an individual's personality traits has been shown to remain stable over time,^{46,47} some literature reports that higher neuroticism scores can become even more extreme with additional exposures to adverse life events.⁴⁸ Therapeutic interventions, however, have been shown to improve high neuroticism scores associated with harmful life outcomes.⁴⁹ Thus, screening for neuroticism in dental residents is important to identify both those at increased risk of developing PTSD and those who may benefit from therapeutic interventions during residency.

However, awareness of mental health resources does not appear to be the norm in dental residency programs across the US. More than one-third of our respondents (38.7%) were unaware of mental health resources provided through their programs. Overall, the two most cited mental health resources provided were wellness events (47.3%) and communication with program directors (46.0%). Such resources can assist in identifying residents who need fur-

TABLE 5 Predictors of diagnostic posttraumatic stress disorder (PTSD) scores among dental residents

Predictor ^a	Diagnostic PTSD score			
	Unadjusted		Adjusted	
	OR (95% CI)	p-Value	OR (95% CI)	p-Value
Gender identity ^b				
Male	1 (Ref)	0.52	1 (Ref)	0.73
Female	1.30 (0.55–3.27)		0.71 (0.20–2.15)	
Age ^c	0.98 (0.90–1.10)	0.79	1.06 (0.95–1.18)	0.24
Race				
Non-White	1 (Ref)	0.79	1 (Ref)	0.31
White	1.12 (0.48–2.61)		1.80 (0.57–5.67)	
Place of birth				
US	1 (Ref)	0.62	NA	NA
Outside of US	1.26 (0.50–3.18)		NA	
Military status				
Civilian	1 (Ref)	0.46	1 (Ref)	0.39
Military or military related	0.45 (0.05–3.69)		0.24 (0.10–5.95)	
Program type				
DA/OMFS	1 (Ref)	NA	1 (Ref)	NA
AEGD/GPR	2.90 (0.79–10.60)	0.11	1.48 (0.24–8.94)	0.67
PED	1.10 (0.22–5.30)	0.91	0.54 (0.06–4.39)	0.57
Program year				
1	1 (Ref)	NA	NA	NA
≥2	0.77 (0.26–2.30)	0.65		
Graduated	1.27 (0.46–3.50)	0.64		
Role during COVID-19 pandemic				
No patient care	1 (Ref)	NA	1 (Ref)	NA
Dental patient care	2.43 (0.52–11.30)	0.26	1.30 (0.27–7.46)	0.77
COVID-19 patient care	2.00 (0.35–11.40)	0.44	1.68 (0.20–13.98)	0.63
Source of reported stress				
No stress	1 (Ref)	NA	1 (Ref)	NA
Stress related to resident role	3.40 (1.10–14.00)	0.04	2.90 (0.66–12.76)	0.16
Stress not related to resident role	9.10 (2.73–30.30)	<0.001	5.88 (1.40–24.69)	0.02
Previously diagnosed with PTSD				
No	1 (Ref)	0.06	1 (Ref)	0.19
Yes	10.17 (0.88–116.60)		0.36 (0.78–1.66)	
Personality traits ^c				
Agreeableness	0.64 (0.27–1.51)	0.32	0.81 (0.25–2.57)	0.73
Conscientiousness	0.44 (0.22–0.91)	0.03	0.65 (0.24–1.77)	0.41
Extraversion	1.00 (0.57–1.80)	0.96	1.58 (0.73–3.45)	0.25
Neuroticism	3.76 (1.84–7.71)	<0.001	2.90 (1.02–8.26)	0.04
Openness	0.54 (0.22–1.31)	0.17	0.42 (0.12–1.48)	0.18

Abbreviations: AEGD, advanced education in general dentistry; CI, confidence interval; COVID-19, coronavirus disease 2019; DA, dental anesthesia; GPR, general practice residency; NA, not applicable; OMFS, oral and maxillofacial surgery; OR, odds ratio; PED, pediatric dentistry; Ref, reference.

^aSample size for all predictors was 149 participants unless otherwise indicated.

^bSample size for gender comprised 146 participants.

^cContinuous.

ther help and link them to specialized mental healthcare and counseling. Only 3.3% of residents were referred to a PTSD clinic, which is an evidence-supported treatment for PTSD. During emergencies such as the COVID-19 pandemic, it is imperative that schools and programs take a more active role in managing the mental health of their students through screening and evidence-supported treatments. An embedded counseling office within the dental school, for example, has been shown to increase overall functioning and decrease mental health symptoms among dental students and residents.⁵⁰ This is one such way that programs can facilitate awareness of available resources and how to access them.

Our study found that conscientiousness, a measure of efficiency and organization, was negatively associated with PTSD symptoms. This result is consistent with other findings from the literature^{24,27} suggesting that high conscientiousness is protective against the development of PTSD. Conscientiousness became statistically insignificant in adjusted calculations, possibly because of its negative correlation with neuroticism, which was found in both this study and the literature.^{51,52} Many of the literature describing the association between conscientiousness and neuroticism (including the current study) has focused on between-individual comparisons in which populations with higher neuroticism also have lower conscientiousness. In contrast, within-individual studies have reported a positive correlation between neuroticism and conscientiousness within one person. This is especially true among individuals who “operate in a demanding work environment where conscientious behaviors are typically rewarded.”⁵³ During the COVID-19 pandemic, essential healthcare workers are the quintessential example of such a population. The conscientious behaviors expected of dental residents who continued to work during the pandemic may be correlated with the higher level of conscientiousness within the study population, without its presumed protection against diagnostic PTSD scores.

We also found no association between PTSD scores and agreeableness, extraversion, or openness. Low agreeableness has been linked to PTSD in some studies^{27,54} but not in others.⁵⁵ Similarly, some studies have shown a correlation between low extraversion and PTSD symptoms,^{56,57} whereas others have not.⁵⁸ Furthermore, a link between openness and PTSD has not been established.^{58,59}

Stress was also associated with PTSD in our analysis. Residents who reported stress that was not related to their clinical role during the pandemic had six times higher odds of reporting diagnostic PTSD scores, and those who reported stress related to their role as a resident had three times higher odds compared with residents who reported no stressful experiences. Nonetheless, after controlling for potential confounders, only stress not related to the res-

ident's role remained significant. Data about particular stressors were not collected in the survey to avoid triggering anxiety among participants. Residents who reported dental role-related stress were likely to also have high neuroticism. Another explanation is that role-related stress, such as the anxiety related to contracting SARS-CoV-2 while treating patients, was insufficient to cause a traumatic experience. Conversely, non-role-related sources of stress can vary widely and are more likely to involve traumatic events, such as a COVID-19 diagnosis, complications affecting the resident or their loved ones, or other sources of abuse or violence.

Although residency type was not significantly associated with diagnostic PTSD scores, there were significant differences in mean PTSD scores between residency program types. The DA/OMFS residents had the lowest mean PTSD score (11.80, range = 7.95–15.80) compared with the AEGD/GPR (18.10, range = 14.90–21.20) and PED (12.10, range = 7.10–17.00) residents. In addition, AEGD/GPR residents also had the highest mean neuroticism score and the lowest mean conscientiousness score compared with the other groups. Thus, differences in PTSD scores appear to be associated with personality traits rather than program type.

Role assignment during the COVID-19 pandemic was not associated with PTSD scores in our study. Shechter et al.⁶⁰ found a significant correlation between working in a COVID-19-focused area and increases in PTSD symptom severity. Nonetheless, residents who saw patients were twice as likely to report diagnostic PTSD levels than those who did not see patients. A larger sample size could increase the significance level of this finding.

Overall, our findings suggest that the mental health needs of dental residents are not being met. Residency programs can help residents access mental healthcare, support, and other resources by providing confidential self-administered screening and decision support tools. These anonymous reports can be used by programs to identify needs and take proactive steps to address them.

This study had several limitations. There are also numerous methods to score the BFI, which further makes comparisons difficult. The personality trait scores in our study were calculated as the means of a scale ranging from 0 to 5, which is similar to scoring used in studies of the personality traits of medical professionals.^{30,61} However, studies of personality traits in the general population have scored in various ways, including the use of percentiles on a normal curve. Because raw scores of personality traits among the general population are not readily available, they cannot be statistically compared with the personality traits of the dental residents in the current study.

Residents who completed the survey may have had different stress levels than those who did not, resulting in

an overestimation or underestimation of PTSD symptoms. As a result, the generalizability of our findings is limited. In addition, 27.3% of respondents did not complete the survey, possibly due to its length and/or inclusion of sensitive questions related to mental health. In addition, the response rate could not be estimated because survey distribution was dependent on program directors and coordinators providing the survey to their residents. To establish direct contact with participants and improve the response rate and sample size, future studies may need to obtain residents' email addresses. More research is needed regarding the personality traits and sources of stress among dental residents given their value in predicting PTSD.

5 | CONCLUSION

In this cross-sectional study, PTSD symptoms were highly prevalent among dental residents. Although neuroticism trait scores were the lowest of the personality trait scores in our sample, they were the most significant predictor of PTSD symptoms. Personality trait scores for agreeableness were highest among our sample of dental residents. Stressful experiences unrelated to residents' professional roles were another significant predictor of PTSD symptom severity. The prevalence of PTSD symptoms suggests that the mental health of dental residents is not currently being met. Residency programs can address this deficiency by screening and offering mental health resources and evidence-supported services.

REFERENCES

- Bhalla N, Suneja N, Kobryn A, Lew S, Dym H. The psychological well-being of medical versus dental GME residents during the COVID-19 pandemic: a cross sectional study. *J Oral Maxillofac Surg*. 2021;79(9):1828.e1-1828.e8. <https://doi.org/10.1016/j.joms.2021.04.016>
- Sarapultseva M, Zolotareva A, Kritsky I, Nasretdinova N, Sarapultsev A. Psychological distress and post-traumatic symptomatology among dental healthcare workers in Russia: results of a pilot study. *Int J Environ Res Public Health*. 2021;18(2):708. <https://doi.org/10.3390/ijerph18020708>
- Congressional Budget Office. *The Veterans Health Administration's Treatment of PTSD and Traumatic Brain Injury Among Recent Combat Veterans*. Publication no. 4097. Congressional Budget Office, Congress of the United States; 2012. Accessed May 20, 2021. https://www.cbo.gov/sites/default/files/112th-congress-2011-2012/reports/02-09-PTSD_0.pdf
- Carmassi C, Bertelloni CA, Avella MT, et al. PTSD and burnout are related to lifetime mood spectrum in emergency healthcare operator. *Clin Pract Epidemiol Ment Health*. 2020;16:165-173. <https://doi.org/10.2174/1745017902016010165>
- Gamio L. The workers who face the greatest coronavirus risk. *The New York Times*. March 15, 2020. Accessed May 17, 2021. <https://www.nytimes.com/interactive/2020/03/15/business/economy/coronavirus-worker-risk.html>
- Khanagar SB, Alfadley A. Psychological impact of the COVID-19 pandemic on dental interns in Riyadh, Saudi Arabia: a cross-sectional survey. *Int J Clin Pediatr Dent*. 2020;13(5):508-512. <https://doi.org/10.5005/jp-journals-10005-1773>
- Brkic H. Dental medicine and COVID-19 pandemic. *Acta Stomatol Croat*. 2020;54(2):118-120.
- Vergara-Buenaventura A, Chavez-Tunon M, Castro-Ruiz C. The mental health consequences of coronavirus disease 2019 pandemic in dentistry. *Disaster Med Public Health Prep*. 2020;14(6):e31-e34. <https://doi.org/10.1017/dmp.2020.190>
- Singh H, Kumar A, Gupta A, Redhu A, Singh A. Impact of COVID-19 on Indian dentists: a cross sectional survey. *J Indian Acad Dent Spec Res*. 2020;32(4):360-365. https://doi.org/10.4103/jiaomr.jiaomr_111_20
- Wu JH, Lee MK, Lee CY, et al. The impact of the COVID-19 epidemic on the utilization of dental services and attitudes of dental residents at the emergency department of a medical center in Taiwan. *J Dent Sci*. 2021;16(3):868-876. <https://doi.org/10.1016/j.jds.2020.12.012>
- Mijiritsky E, Hamama-Raz Y, Liu F, et al. Subjective overload and psychological distress among dentists during COVID-19. *Int J Environ Res Public Health*. 2020;17(14):5074. <https://doi.org/10.3390/ijerph17145074>
- Tao J, Lin Y, Jiang L, et al. Psychological impact of the COVID-19 pandemic on emergency dental care providers on the front lines in China. *Int Dent J*. 2021;71(3):197-205. <https://doi.org/10.1016/j.identj.2020.12.001>
- Zhao D, Yu J, Zhang T, et al. Impact of COVID-19 on advanced dental education: perspectives of dental residents in Wuhan. *J Dent Educ*. 2021;85(6):756-767. <https://doi.org/10.1002/jdd.12570>
- Wu DT, Wu KY, Nguyen TT, Tran SD. The impact of COVID-19 on dental education in North America—where do we go next? *Eur J Dent Educ*. 2020;24(4):825-827. <https://doi.org/10.1111/eje.12561>
- Chi DL, Randall CL, Hill CM. Dental trainees' mental health and intention to leave their programs during the COVID-19 pandemic. *J Am Dent Assoc*. 2021;152(7):526-534. <https://doi.org/10.1016/j.adaj.2021.02.012>
- Hung M, Licari FW, Hon ES, et al. In an era of uncertainty: impact of COVID-19 on dental education. *J Dent Educ*. 2021;85(2):148-156. <https://doi.org/10.1002/jdd.12404>
- Smith C, Rao A, Tompach PC, Petersen A, Lyu D, Nadeau RA. Factors associated with the mental health and satisfaction of oral and maxillofacial surgery residents in the United States: a cross-sectional study and analysis. *J Oral Maxillofac Surg*. 2019;77(11):2196-2204. <https://doi.org/10.1016/j.joms.2019.07.005>
- Jackson T, Provencio A, Bentley-Kumar K, et al. PTSD and surgical residents: everybody hurts... sometimes. *Am J Surg*. 2017;214(6):1118-1124. <https://doi.org/10.1016/j.amjsurg.2017.08.037>
- Ruitenburt MM, Frings-Dresen MHW, Sluiter JK. The prevalence of common mental disorders among hospital physicians and their association with self-reported work ability: a cross-sectional study. *BMC Health Serv Res*. 2012;12:292-298. <https://doi.org/10.1186/1472-6963-12-292>
- Chakraborty T, Subbiah GK, Damade Y. Psychological distress during COVID-19 lockdown among dental students and

- practitioners in India: a cross-sectional survey. *Eur J Dent.* 2020;14(suppl 1):S70-S78. <https://doi.org/10.1055/s-0040-1719211>
21. Amin D, Austin TM, Roser SM, Abramowicz S. A cross-sectional survey of anxiety levels of oral and maxillofacial surgery residents during the early COVID-19 pandemic. *Oral Surg Oral Med Oral Pathol Oral Radiol.* 2021;132(2):137-144. <https://doi.org/10.1016/j.oooo.2021.01.024>
 22. Garcia DT, Akinkugbe AA, Mosavel M, Smith CS, Brickhouse TH. COVID-19 and dental and dental hygiene students' career plans. *JDR Clin Trans Res.* 2021;6(2):153-160. <https://doi.org/10.1177/2380084420984772>
 23. Watkins LE, Sprang KR, Rothbaum BO. Treating PTSD: a review of evidence-based psychotherapy interventions. *Front Behav Neurosci.* 2018;12:258. <https://doi.org/10.3389/fnbeh.2018.00258>
 24. Jakšić N, Brajković L, Ivezić E, Topić R, Jakovljević M. The role of personality traits in posttraumatic stress disorder (PTSD). *Psychiatr Danub.* 2012;24(3):256-266.
 25. Costa PT, McCrae RR. The five-factor model of personality and its relevance to personality disorders. *J Pers Disord.* 1992;6:360-371.
 26. Kotov R, Gamez W, Schmidt F, Watson D. Linking "big" personality traits to anxiety, depressive, and substance use disorders: a meta-analysis. *Psychol Bull.* 2010;136(5):768-821. <https://doi.org/10.1037/a0020327>
 27. Caska CM, Renshaw KD. Personality traits as moderators of the associations between deployment experiences and PTSD symptoms in OEF/OIF service members. *Anxiety Stress Coping.* 2013;26(1):36-51. <https://doi.org/10.1080/10615806.2011.638053>
 28. Lewis EG, Cardwell JM. The Big Five personality traits, perfectionism and their association with mental health among UK students on professional degree programmes. *BMC Psychol.* 2020;8(1):54. <https://doi.org/10.1186/s40359-020-00423-3>
 29. Stienen MN, Scholtes F, Samuel R, Weil A, Weyerbrock A, Surbeck W. Different but similar: personality traits of surgeons and internists-results of a cross-sectional observational study. *BMJ Open.* 2018;8(7):e021310. <https://doi.org/10.1136/bmjopen-2017-021310>
 30. Hoffman BM, Coons MJ, Kuo PC. Personality differences between surgery residents, nonsurgery residents, and medical students. *Surgery.* 2010;148(2):187-193. <https://doi.org/10.1016/j.surg.2010.04.005>
 31. Tolin DF, Foa EB. Sex differences in trauma and posttraumatic stress disorder: a quantitative review of 25 years of research. *Psychol Bull.* 2006;132(6):959-992. <https://doi.org/10.1037/0033-2909.132.6.959>
 32. Xue C, Ge Y, Tang B, et al. A meta-analysis of risk factors for combat-related PTSD among military personnel and veterans. *PLoS One.* 2015;10(3):e0120270. <https://doi.org/10.1371/journal.pone.0120270>
 33. Goldberg LR. The structure of phenotypic personality traits. *Am Psychol.* 1993;48(1):26-34. <https://doi.org/10.1037/0003-066X.48.1.26>
 34. Woods SA, Hampson SE. Measuring the Big Five with single items using a bipolar response scale. *Eur J Personality.* 2005;19(5):373-390. <https://doi.org/10.1002/per.542>
 35. John OP, Srivastava S. The Big Five trait taxonomy: history, measurement, and theoretical perspectives. In: Pervin LA, John OP, eds. *Handbook of Personality: Theory and Research*. Guilford Press; 1999:102-138.
 36. Blevins CA, Weathers FW, Davis MT, Witte TK, Domino JL. The Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5): development and initial psychometric evaluation. *J Trauma Stress.* 2015;28(6):489-498. <https://doi.org/10.1002/jts.22059>
 37. Wortmann JH, Jordan AH, Weathers FW, et al. Psychometric analysis of the PTSD Checklist-5 (PCL-5) among treatment-seeking military service members. *Psychol Assess.* 2016;28(11):1392-1403. <https://doi.org/10.1037/pas0000260>
 38. Armour C, Contractor A, Shea T, Elhai JD, Pietrzak RH. Factor structure of the PTSD Checklist for DSM-5: relationships among symptom clusters, anger, and impulsivity. *J Nerv Ment Dis.* 2016;204(2):108-115. <https://doi.org/10.1097/NMD.0000000000000430>
 39. U.S. Department of Veterans Affairs. *PTSD: National Center for PTSD*. Updated April 6, 2022. Accessed May 12, 2022. <https://www.ptsd.va.gov/professional/assessment/adult-sr/ptsd-checklist.asp>
 40. Sveen J, Bondjers K, Willebrand M. Psychometric properties of the PTSD Checklist for DSM-5: a pilot study. *Eur J Psychotraumatol.* 2016;7:30165. <https://doi.org/10.3402/ejpt.v7.30165>
 41. Bovin MJ, Marx BP, Weathers FW, et al. Psychometric properties of the PTSD Checklist for Diagnostic and Statistical Manual of Mental Disorders-Fifth Edition (PCL-5) in veterans. *Psychol Assess.* 2016;28(11):1379-1391. <https://doi.org/10.1037/pas0000254>
 42. Schein J, Houle C, Urganus A, et al. Prevalence of post-traumatic stress disorder in the United States: a systematic literature review. *Curr Med Res Opin.* 2021;37(12):2151-2161. <https://doi.org/10.1080/03007995.2021.1978417>
 43. Berger W, Coutinho ESF, Figueira I, et al. Rescuers at risk: a systematic review and meta-regression analysis of the worldwide current prevalence and correlates of PTSD in rescue workers. *Soc Psychiatry Psychiatr Epidemiol.* 2012;47(6):1001-1011. <https://doi.org/10.1007/s00127-011-0408-2>
 44. Bharadwaj P, Pai MM, Suziedelyte A. Mental health stigma. *Econ Lett.* 2017;159:57-60. <https://doi.org/10.1016/j.econlet.2017.06.028>
 45. Ogle CM, Siegler IC, Beckham JC, Rubin DC. Neuroticism increases PTSD symptom severity by amplifying the emotionality, rehearsal, and centrality of trauma memories. *J Pers.* 2017;85(5):702-715. <https://doi.org/10.1111/jopy.12278>
 46. Atherton OE, Sutin AR, Terracciano A, Robins RW. Stability and change in the Big Five personality traits: findings from a longitudinal study of Mexican-origin adults. *J Pers Soc Psychol.* 2021;122(2):337-350. <https://doi.org/10.1037/pspp0000385>
 47. Lütke O, Roberts BW, Trautwein U, Nagy G. A random walk down university avenue: life paths, life events, and personality trait change at the transition to university life. *J Pers Soc Psychol.* 2011;101(3):620-637. <https://doi.org/10.1037/a0023743>
 48. Boals A, Southard-Dobbs S, Blumenthal H. Adverse events in emerging adulthood are associated with increases in neuroticism. *J Pers.* 2015;83(2):202-211. <https://doi.org/10.1111/jopy.12095>
 49. Spinhoven P, Huijbers MJ, Ormel J, Speckens AEM. Improvement of mindfulness skills during mindfulness-based cognitive therapy predicts long-term reductions of neuroticism in persons with recurrent depression in remission. *J Affect Disord.* 2017;213:112-117. <https://doi.org/10.1016/j.jad.2017.02.011>
 50. Adams DF. The embedded counseling model: an application to dental students. *J Dent Educ.* 2017;81(1):29-35.

51. Kozlová S, Vesela J, Stehlik M. Neuroticism and its association with conscientiousness and blood creatine kinase in soldiers. Paper presented at: The International Applied Military Psychology Symposium, Sarajevo, Bosnia and Herzegovina. May 6–10, 2019. http://www.iamps.org/papers/2019_KOZLOVA_paper.pdf
52. Mount MK, Barrick MR, Scullen SM, Rounds J. Higher-order dimension of the Big Five personality traits and the Big Six vocational interest types. *Pers Psychol*. 2005;58(2):447-478. <https://doi.org/10.1111/j.1744-6570.2005.00468.x>
53. Beckmann N, Wood RE, Minbashian A. It depends how you look at it: on the relationship between neuroticism and conscientiousness at the within- and the between-person levels of analysis. *J Res Pers*. 2010;44(5):593-601. <https://doi.org/10.1016/j.jrp.2010.07.004>
54. Talbert FS, Braswell LC, Albrecht JW, Hyer LA, Boudewyns PA. NEO-PI profiles in PTSD as a function of trauma level. *J Clin Psychol*. 1993;49(5):663-669. [https://doi.org/10.1002/1097-4679\(199309\)49:5%3C663::aid-jclp2270490508%3E3.0.co;2-a](https://doi.org/10.1002/1097-4679(199309)49:5%3C663::aid-jclp2270490508%3E3.0.co;2-a)
55. Schnurr PP, Friedman MJ, Rosenber SD. Premilitary MMPI scores as predictors of combat-related PTSD symptoms. *Am J Psychiatry*. 1993;150(3):479-483. <https://doi.org/10.1176/ajp.150.3.479>
56. Fauerbach JA, Lawrence JW, Schmidt CW Jr, Munster AM. Personality predictors of injury-related posttraumatic stress disorder. *J Ner Ment Dis*. 2000;188(8):510-517. <https://doi.org/10.1097/00005053-200008000-00006>
57. Dorfel D, Rabe S, Karl A. Coping strategies in daily life as protective and risk factors for post traumatic stress in motor vehicle accident survivors. *J Loss Trauma*. 2008;13(5):422-440. <https://doi.org/10.1080/15325020701742136>
58. Chung MC, Berger Z, Rudd H. Comorbidity and personality traits in patients with different levels of posttraumatic stress disorder following myocardial infarction. *Psychiatry Res*. 2007;152(2-3):243-252. <https://doi.org/10.1016/j.psychres.2007.02.008>
59. Ponce de León B, Andersen S, Karstoft KI, Elklit A. Pre-deployment dissociation and personality as risk factors for post-deployment post-traumatic stress disorder in Danish soldiers deployed to Afghanistan. *Eur J Psychotraumatol*. 2018;9(1):1443672. <https://doi.org/10.1080/20008198.2018.1443672>
60. Shechter A, Chiuzan C, Shang Y, et al. Prevalence, incidence, and factors associated with posttraumatic stress at three-month follow-up among New York City healthcare workers after the first wave of the COVID-19 pandemic. *Int J Environ Res Public Health*. 2021;19(1):262. <https://doi.org/10.3390/ijerph19010262>
61. Kim MH, Mazenga AC, Yu X, et al. Factors associated with burnout amongst healthcare workers providing HIV care in Malawi. *PLoS One*. 2019;14(9):e0222638. <https://doi.org/10.1371/journal.pone.0222638>

How to cite this article: Metz M, Whitehill R, Alraiq HM. Personality traits and risk of posttraumatic stress disorder among dental residents during COVID-19 crisis. *J Dent Educ*. 2022;1-11. <https://doi.org/10.1002/jdd.13034>